Bosch Headlight Wiper Motor

Disassembly & Restoration

In his document I will do my best to explain the process I went through to disassemble and restore a set of headlight wiper motors for my Volvo 240.

Please Note;

Headlight wipers are only intended to be installed on Volvo 240's with "E-Code" headlights. This type of headlight assembly has a perfectly smooth glass lens which the blade can glide over easily

U.S. 240's have D.O.T. Code lights
These have a completely different assembly with a plastic lens, which has 3 little nubs in the center placed in a triangular pattern.

Why, I don't know. But they're there.

So unless you plan on sanding down the 3 little nubs found on each headlight lens, go E-Code.

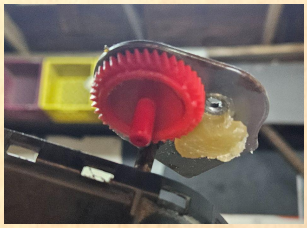
This paper isn't about E Code lights though, there are plenty of forums and sources which can explain all that far better than me. I highly recommend looking into it

Original Condition

I found this set of Volvo 240 headlight wiper motors by sheer luck and timing on Facebook Marketplace. Finding these in the U.S. is very hard, so I knew whatever condition they were in was what I had to deal with.

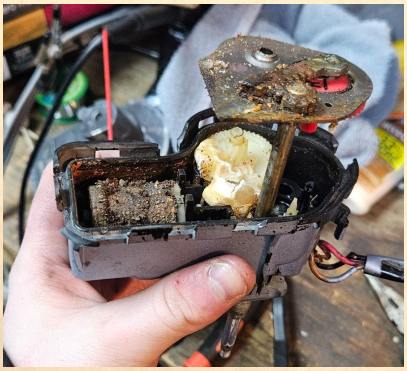
Due to the age of these motors, many of them suffer from broken plastic gears. I got lucky, this pair was removed before that could happen. However as you can see, the right motor didn't hold up as well

The Exterior of each wasn't anything unexpected, however the wires were only hanging on by a thread

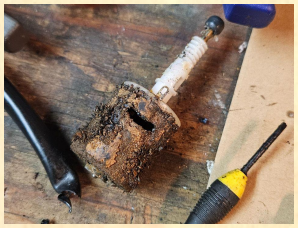


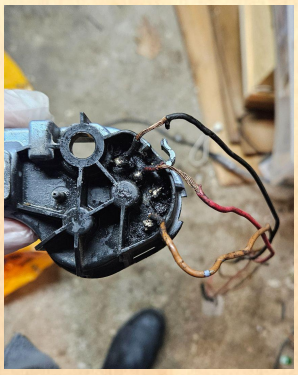
This is the left motor.

Not too bad, just some solidified grease and light rust



…and here's its brother, which had a LOT of rust. Not only had the grease solidified, it had turned into…cheese?





The solder points for the wires were covered in potting, which I chiseled off with a flathead screwdriver. As you can see, the wire insulation wasn't in great shape

These are some of the only 'before' pictures because I didn't want to touch any more of it without gloves

Restoring The Metal Parts

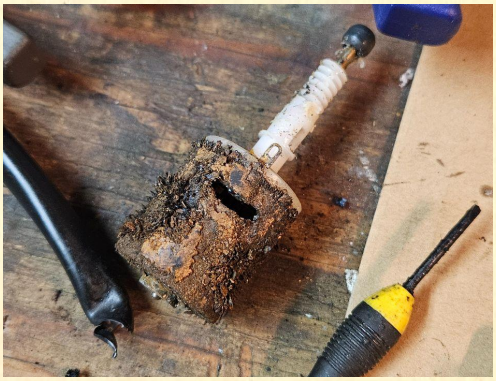
Before I did anything, I got myself a box of nitrile gloves, because I had no desire to get whatever was in those motors all over my hands

While I know it can damage the plastic, brake cleaner was my best friend. It worked great and cleaned everything very well.

However the rust needed some more patience to take care of.
Wire wheels and metal brush drill attachments did most of the cleaning, any metal parts got the treatment.

After most of the rust was cleaned off with the drill, I soaked all metal parts over several days in a non acidic, reusable rust dissolver.

Here you see the green bucket of many things.
These are all of the metal parts both these motors had.
Thanks to this rust dissolver being non acidic, plastic pieces with metal parts attached could be soaked



As seen earlier, here's the DC motor from the right wiper motor. It's one of the more visually impressive examples of the poor state of these motors.

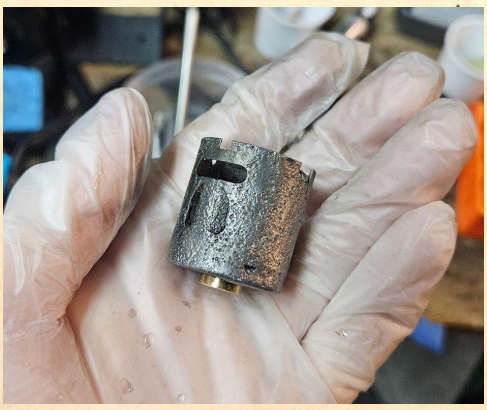
The magnets in the motor attracted iron filings but even after they were brushed off, it was still pretty bad

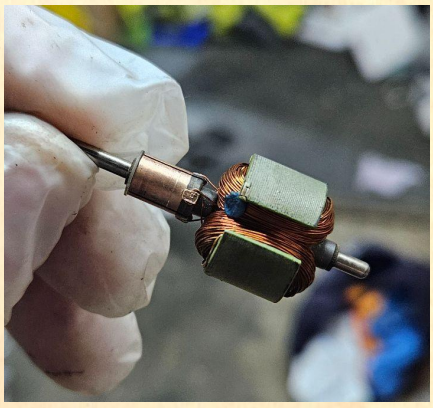
The Result

I disassembled the DC motors themselves to make sure they were properly cleaned.

Most of the rust was removed by the wire tools, however they really shined up after they soaked.

That rust dissolver worked wonders, because the pictures shown below are the exact same motor you saw before





Just...baffling.

I still sometimes can't believe it cleaned up this well

When it comes to the textured surface, I believe that's from the amount of metal which was eaten away by the rust.

Unsurprisingly, the motor works again. It's a bit louder than the other, but also a bit faster.

The other metal parts cleaned up the same, the DC motor is just the best example

Cleaning The Rest Up

Remember that horrendous right motor? Well this is what I got to experience upon further deconstruction.

It looks bad yes, and it was. But the smell was indescribable. Just…nauseating.

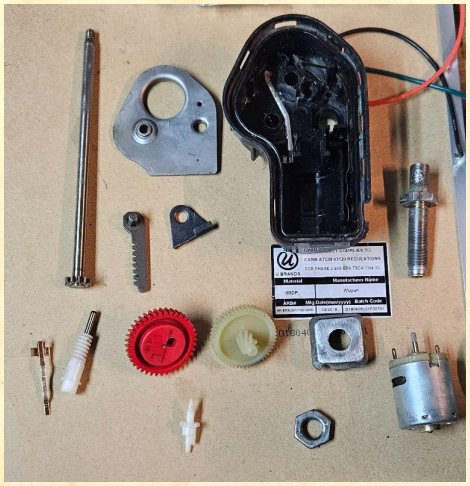
To clean all this off I started with some electronics cleaner on the plastic gears, to try and prevent any damage.

Anything left I worked off with a wire brush, applying light pressure to avoid gouging the plastic.

Then another rinse of electronics cleaner, and finally a brief blast of brake cleaner to blow any more stubborn stuff off.

All the metal stuff got the treatment shown previously.

The housing itself just got a lot of brake cleaner, because I couldn't get anything else in due to the small space.



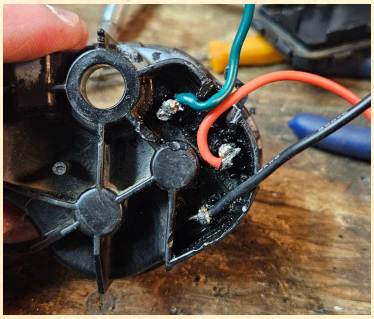
Here you see…not the right motor. This is the first picture I got of all the internal parts laid out after cleaning, it just happened to be the left motor I used for the shot.

Everything cleaned up very well. But if you looked closely, there are some colorful new wires coming from the housing.

Replacing them is relatively simple (if you're decent with a soldering iron, which I am not)

Replacing The Wires

On the first page you saw the poor condition of the wires on each motor, with this they were due for replacement.

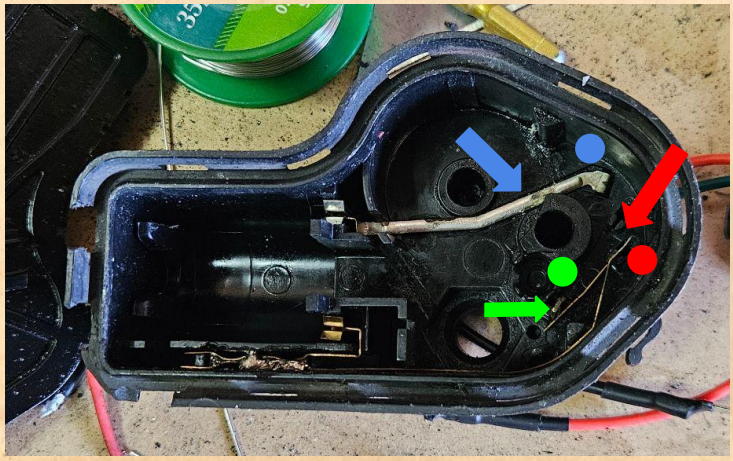


After chisling off the potting which filled that whole space with the connections, and desoldering the old wires, getting the new ones in proved quite annoying

Underneath the blob of solder which it took me to get the new wires to stay, each point has basically a 'U' shaped connection which the wire slots into.

It was surprisingly annoying to hold everything still enough to get a solid connection

I didn't have any potting so I decided that some window sealant should work to fill and cover the wires.



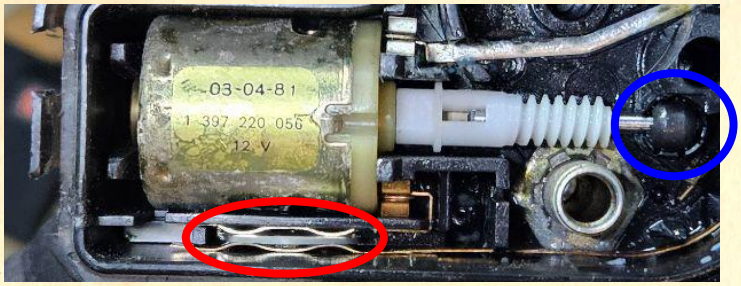
Here is a crude diagram on where the wire connections pass through and what they power.

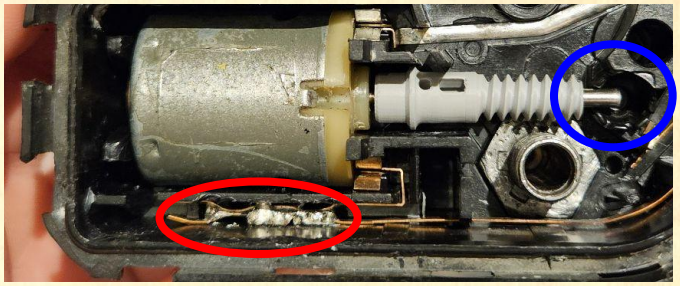
The black wire, represented by blue for visibility, is ground. The silver ribbon connects it to the motor.

The red wire powers the copper ribbon directly, it's what you see at the tip of the red arrow. It runs along the bottom of the housing and eventually leads to the DC motor. The ribbon receives direct power when the active sweep circuit is engaged

The Green wire powers the little piece of metal at the tip of the green arrow. This the parking circuit. A little white cam gear spins around and eventually pushes the copper ribbon off the powered piece of metal. This disconnect should happen when the wipers are in their parked position

Parts that didn't make the restoration





The coin resistor? About the side of a penny.

If anyone knows what this actually is please let me know

The red circle highlights some sort of coin shaped thing. It didn't seem conductive, but it made the connection between the two copper ribbons which power the motor. My guess is some sort of resistor.

Whatever it was, one shattered as soon as I grabbed it with tweezers, and the other just didn't seem to work.

My solution was an orangutan soldering job to make a solid bridge between the two ribbons. It works, and I left it there.

The blue circle highlights what was basically a bead with a hole through it. This slid onto the metal shaft of the worm gear and the housing for it clipped it down.

Unsurprisingly, the moment I popped the motors out, these flew across my garage and have not been found since.

The worm gear in the second photo is a 3D printed part I designed. This part was created due to one motor getting stuck while testing, promptly shredding the original gear. The part I designed fits far tighter onto the motor shaft and doesn't rattle, making the beads' absence nothing to worry about.

From left to right

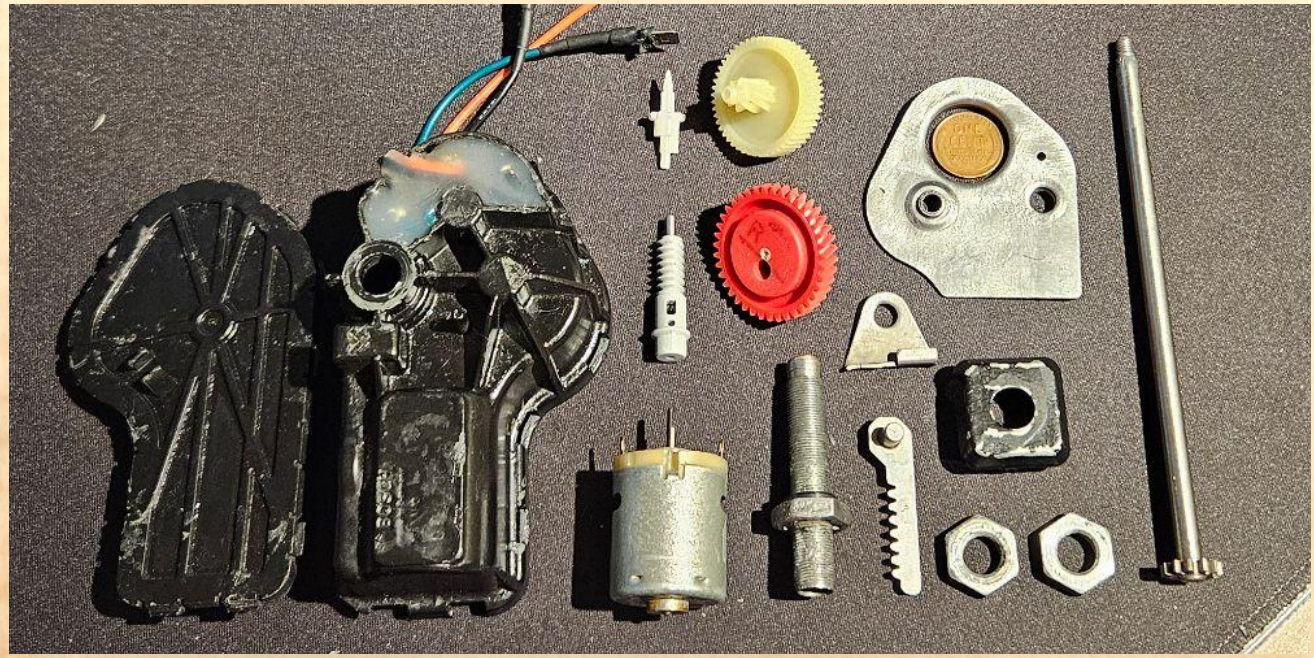
- The original part

-The 3D printed part I had my old internship make

-My crack at making a replacement, which ended up being my final choice

Complete parts layout for one motor

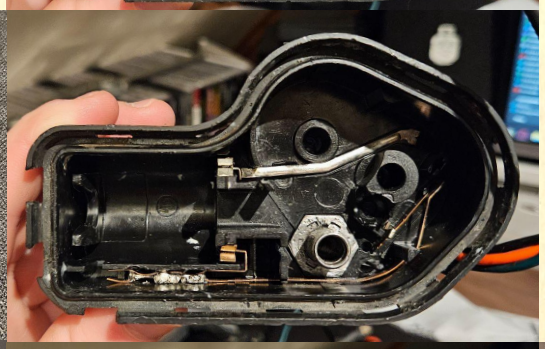
(with wheat penny for scale)

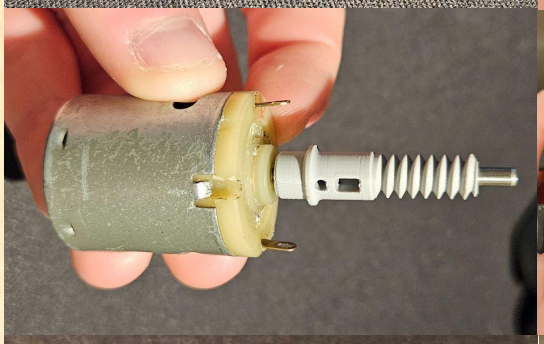


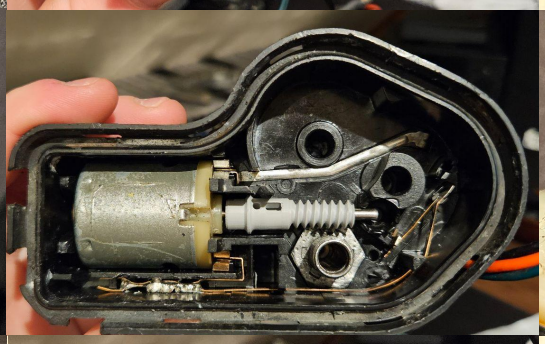
Reassembly

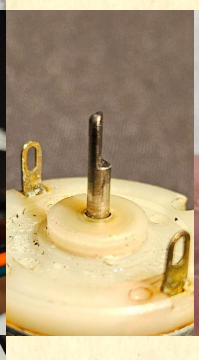
Or disassembly if followed backwards

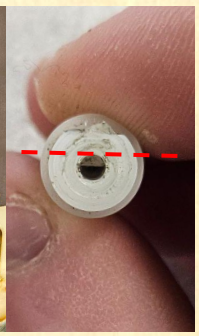
I'll let the pictures do most of the talking

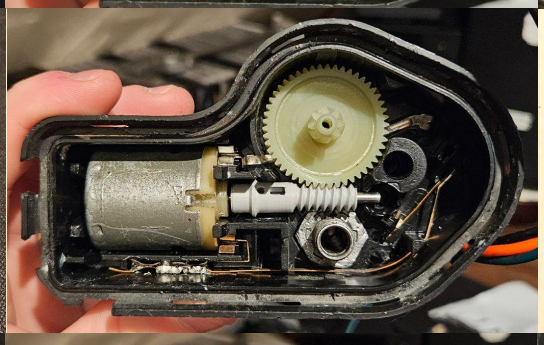






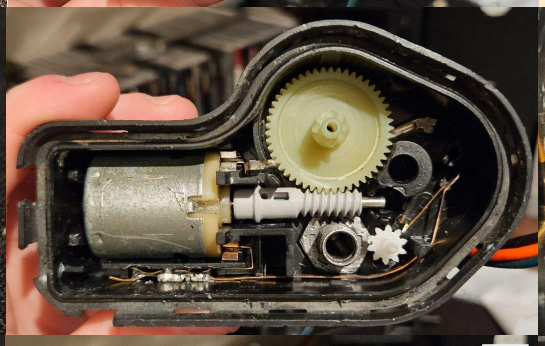


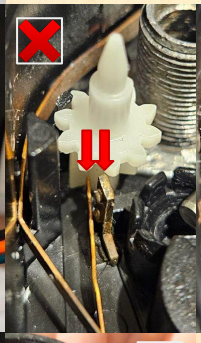


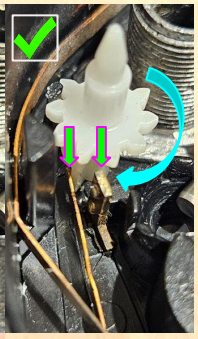


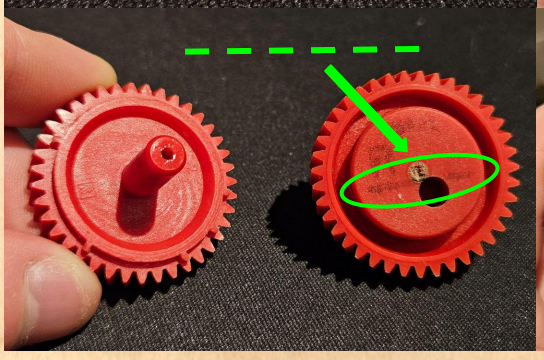
The two points under the arrows are the contacts that time the parking circuit. Rotate the cam gear in its spot until it resembles the correct example.

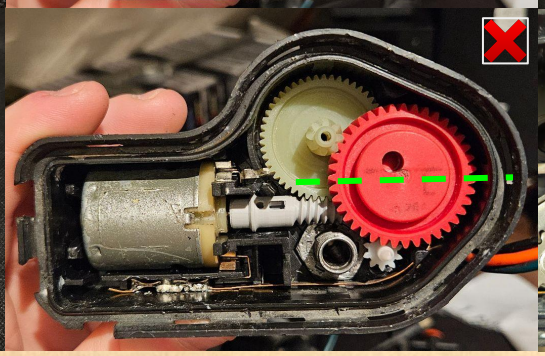
There is a plastic tab on the housing which snaps into one tooth and staggers the gear as it turns. This there to hold the gear in place once it stops. A snapping or clicking noise should be expected during manual rotation

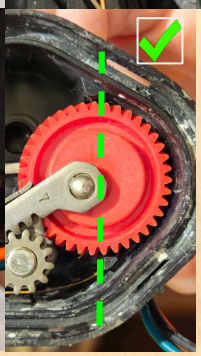




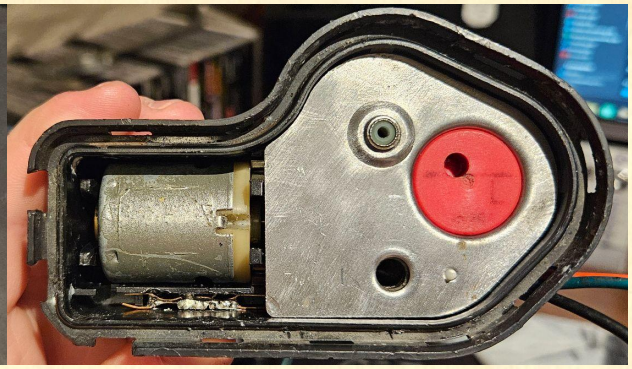








I had taken most of these photos before realizing I didn't have the timing gear (red) aligned properly. The green line shows the orientation they should be in. Each gear has a sharpie line drawn on it which is used as a marker for alignment

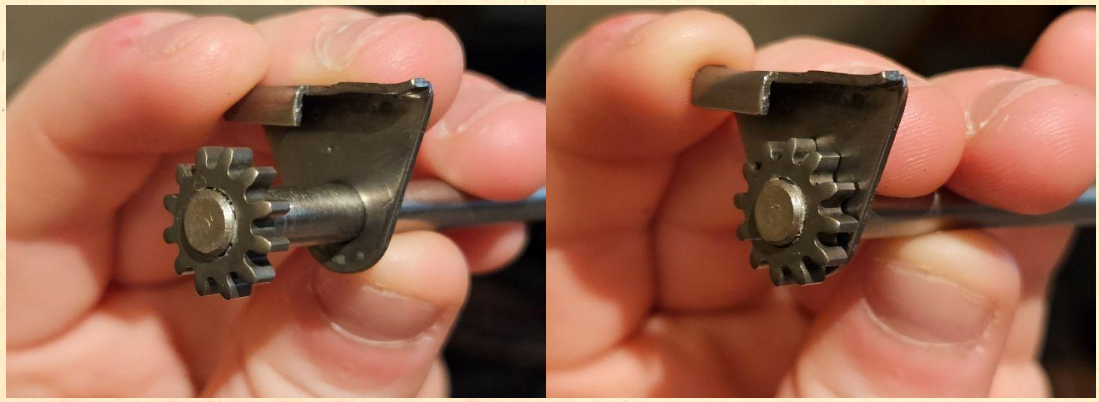


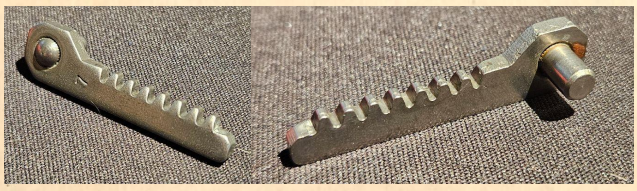
The cover plate is a bit finicky and can be annoying to push down completely.

In regards to disassembly, a small flathead screwdriver wiggled underneath should loosen it up. Or if you have them, a set of “Hemostat Locking Forceps” will make the job much easier.

The next page has better visuals on how to tell if the plate is where it's supposed to be.

These next two steps are done separately from the main housing and the completed assembly is added after

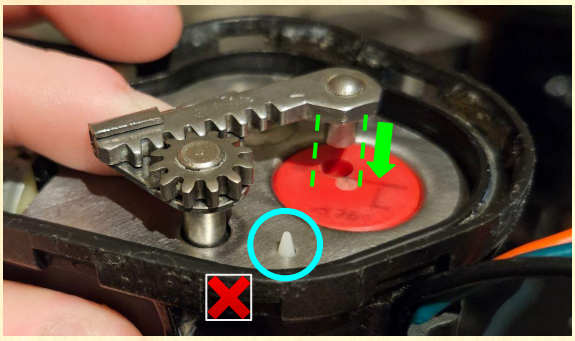




The round peg on the back of the rack gear slides into the hole on the top of the timing gear. Pay attention on installation to make sure the peg is lined up with the gear.

This will be visualized on the next step

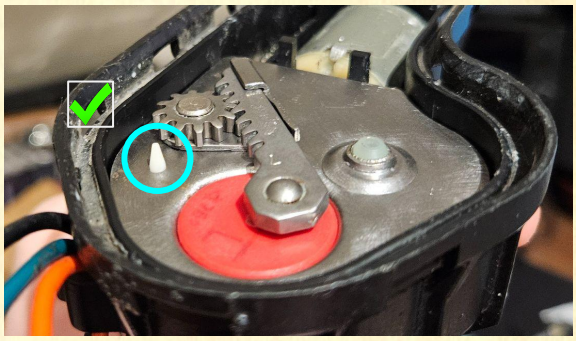
Remember that plate from the previous page? The blue circle shows where the cam gear protrudes through. In the left photo there's less visible, and the plate isn't fully seated. In the right photo it appears the protrusion is taller, this is what is should look like when the plate is fully seated.

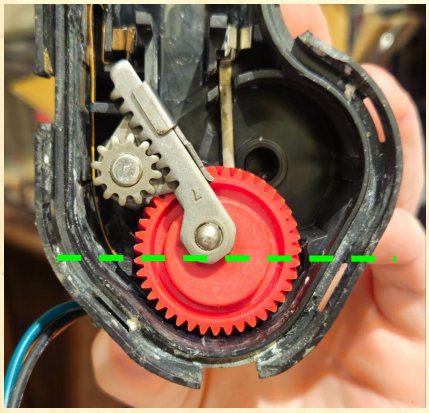


The rod assembly can be stubborn to slide through the center bore. Just rotate the rod a bit and fiddle with it and eventually it should go through.

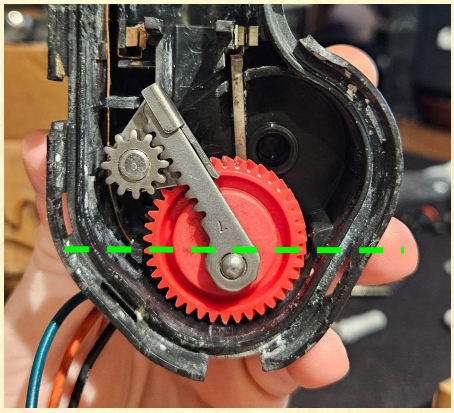
The green dotted lines show what was described in the step before.

This step is significantly easier if you use grease, I sprayed lithium grease in and it went right through.

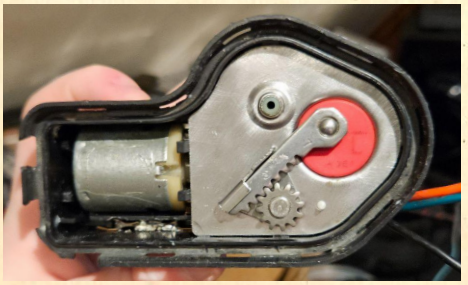




Properly aligned "L" timing gear

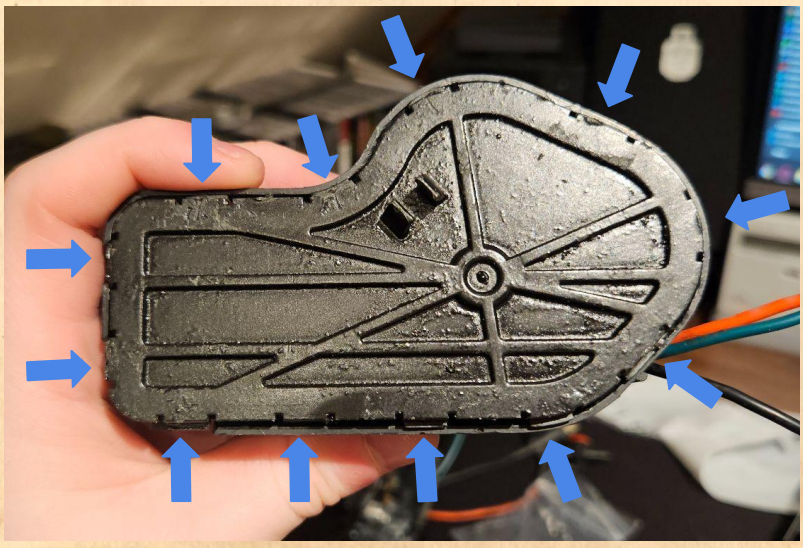


Properly aligned "R" timing gear



This is what the motor should look like when you're done with reassembly

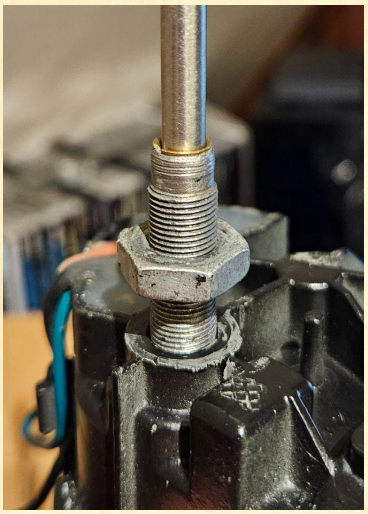
However this picture doesn't have the gears timed properly



All these arrows point to where the back cover clips in. this plastic is very rigid. I had to use a vise to squeeze these in since it was the only thing I had near me that could apply enough pressure.

Unclipping this plate for disassembly can really only be done with a fine tipped flathead screwdriver and some fiddling around.

The skirt on the main housing will likely break in a few places in the removal process. Losing a few of the clips shouldn't pose much of an issue as long as no more than two in a row are broken.

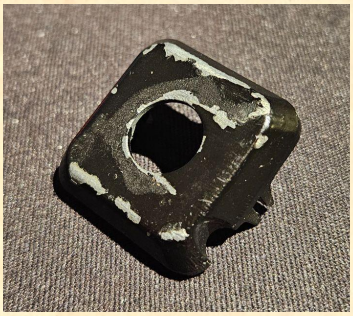


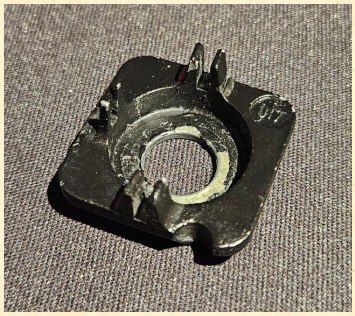
MAKE SURE NOT TO LOSE THESE NUTS!!

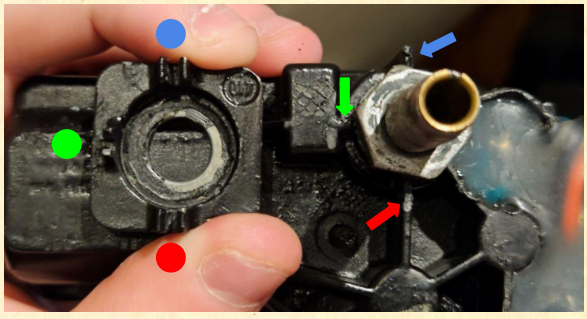
The thread on these parts is extremely fine considering their size, I was unable to find any replacement nuts.

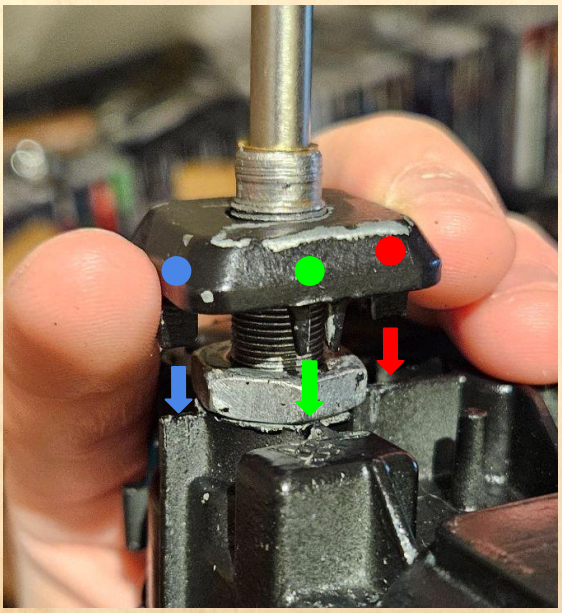
These are also used to mount the motors to the car, so DO NOT LOSE THEM!

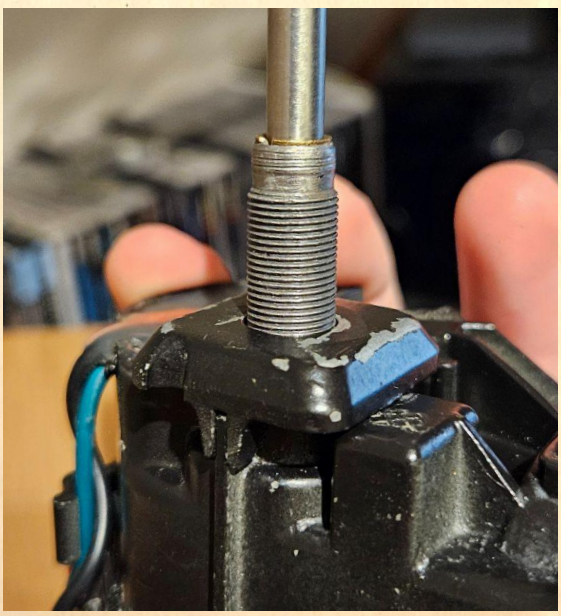
This last step shows the mounting backplate. It provides a larger surface area to make contact with the car. Hopefully the colors help show how this lines up and slides onto the motor











Once the backplate is on, you're all set, the motors have been rebuilt and should be ready for installation.

Missing parts from my motors

Aside from the entire wiring harness, the parts you see circled I simply don't have.

Hopefully yours come with the plastic cover you see circled. I believe this cover is meant to help with weatherproofing. I think its two parts, one being underneath the cover you see in the picture.

The motors will function without them, and with how tight the rod fits through the center bore I don't think it will be a super significant issue.

Things I used for this restoration

This stuff specifically, its great

Lots of thinking

Most of these images are self explanatory., however…

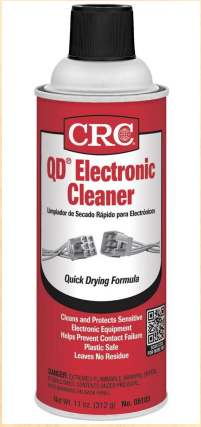
I prefer to use uninsulated spade terminals and insulate it with heat shrink tubing. I think it looks cleaner

Depending on what gloves you get, the brake cleaner might weaken them and they'll rip. Just keep that under consideration.

I don't have a functional Dremel tool, so that's why I used drill bits.

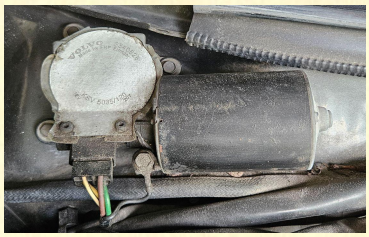
Brass wire brush tools will be useful for parts which would be gouged by steel, like plastics.

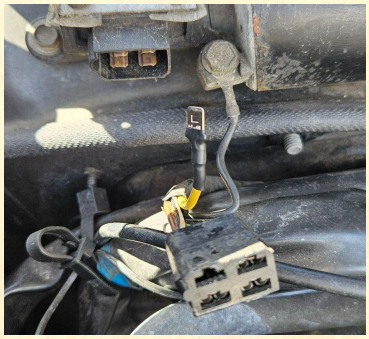
"Hemostat Locking Forceps"

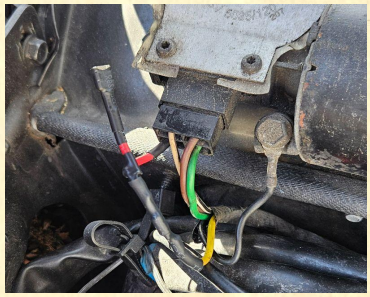


My Wiring Solution

Having resoldered the wires for both motors, and my car being a U.S. model, I basically had zero factory wiring for these. I'll do my best to show what my solution was

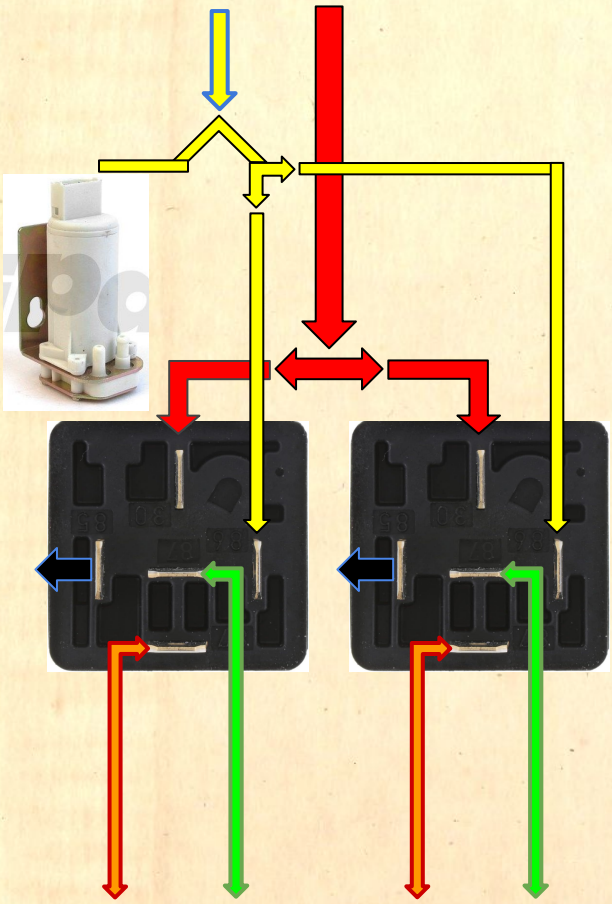






Voila, my best attempt at visualizing my wiring.

I don't have the knowledge of how to make a proper wiring diagram.
This is what I can do instead. Don't worry, there will be an explanation below



- Main power for motor operation. Connects to fuse No.2 Switched with key
- Shared power for washer motor & relay switch
- Relay Ground
- Parking sweep/park circuit power. Power is routed here when relay switch closed
- Active sweep circuit power. Only receives power when relay switch is activated (syncs with washer fluid motor)

Tapping into the system

On the connector for the main wiper motor there will be a yellow wire. This is switched power from fuse No.2, and is the wire which will be spliced.

Unclip the connector and find yourself a very small flathead screwdriver. The quick disconnect terminals for each wire hold themselves in with a little metal tab that clips into the connector housing. Pretty much just slide the flathead into the disconnect for the yellow wire, the goal being to push down the clip holding the connector. It'll be annoying but eventually you'll find an angle that lets you break it loose.

Once the disconnect it out, snip it off and give the wire a new terminal. This will connect to a Y splitter like the one you see in my hand above.

When you make the Y splitter, make sure to have at least one of the two outputs a female connector, as it will need to reattach to the wiper motor.

Once the Y splitter is connected to the yellow wire, slide the original connector for the wiper motor back on. It's much easier to clip in the original housing with the 3 remaining terminals, and slide the y splitter into the missing slot after.

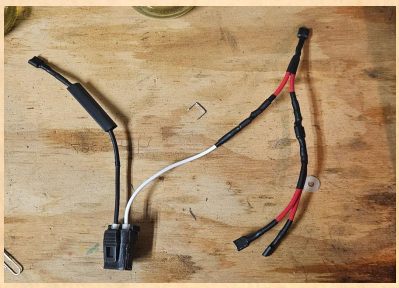
From there run the wire you'll be using for the motors' main power to wherever it needs to go.

The other wire which needs tapping is the blue and yellow wire which powers the washer motor.

The harness pictured below is my creation for getting this split done. As you can see, the blue and yellow is split in two, one side leading to the connector for the washer motor, and the other leading to another Y splitter.

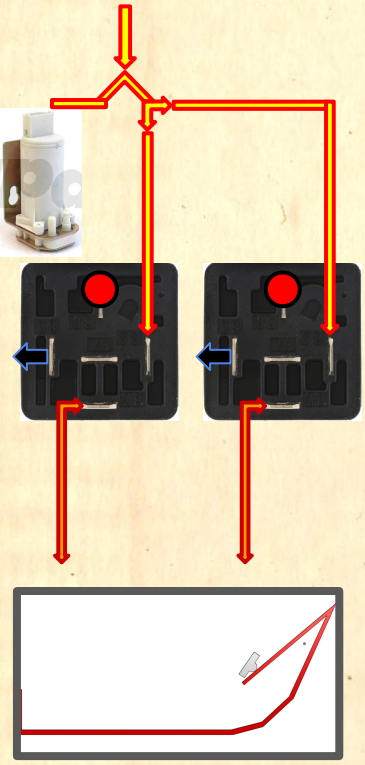
This is represented by the yellow arrows in the wiring visual.

The Y split then connects to the relays, and when the washer motor is powered, the relays receive the signal to switch the output pin

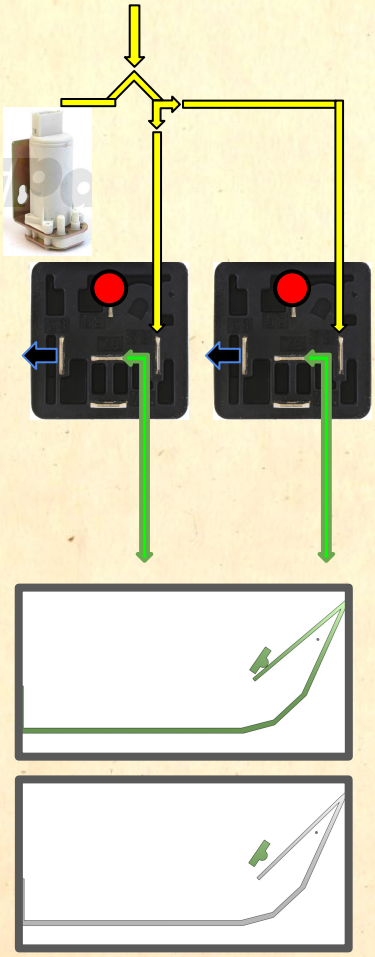


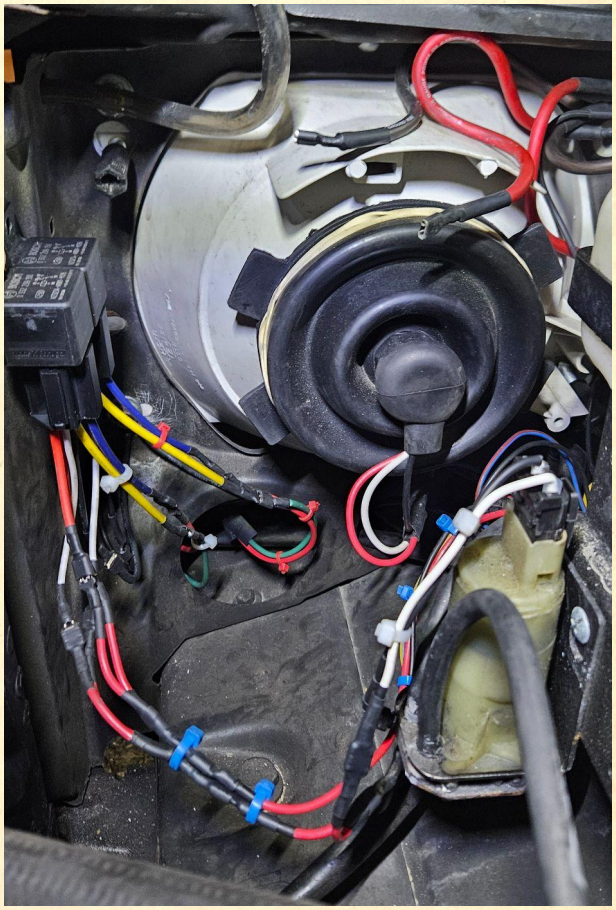
More Wiring Stuff

Active sweep flow chart.
Controlled by wash/wipe on steering column.



Parking sweep/parked flow chart.





The three figures above show the copper ribbon which runs along the bottom of the motor housing.

The color of the ribbon represents which wire is providing it with power.

In the case of the Parking Sweep chart, green also represents the little metal tab that the green wire connects directly to.

Top right Figure -
Ribbon position while parking

Bottom Right Figure -
Ribbon position when parked

This is what that little white cam hear seen earlier controls

This is what the wiring actually looks like in my car.

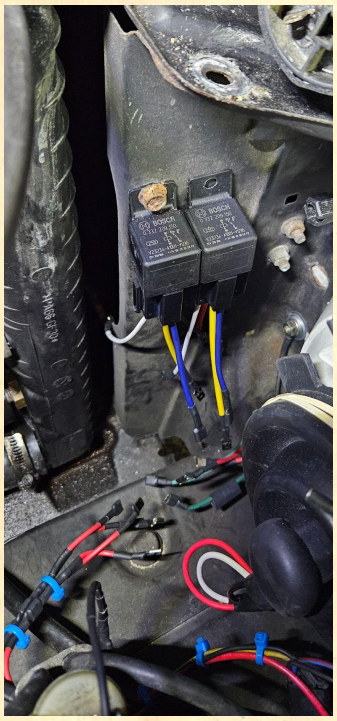
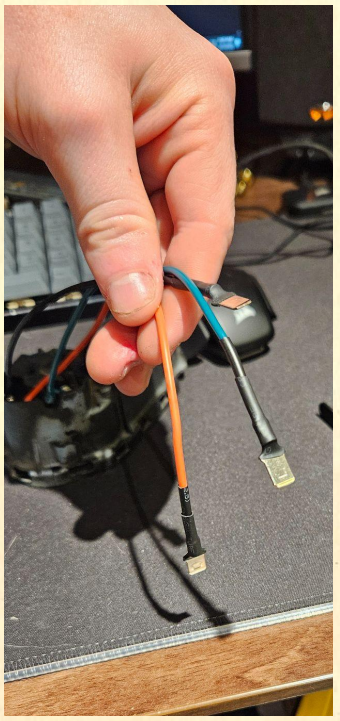
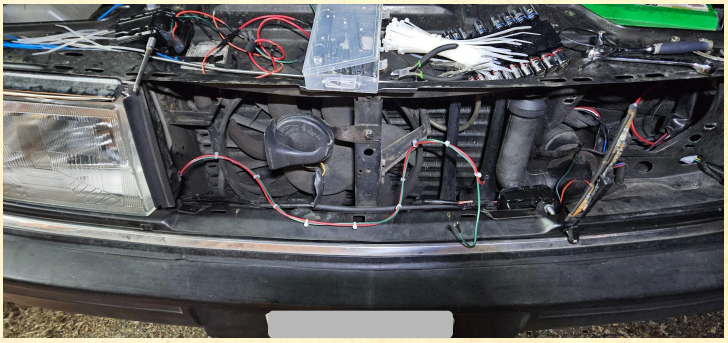
The thick red wires are unrelated, they're for powering the compressor for my train horn

Zip ties are highly recommended.

I made all my connections and splices with terminals as opposed to twisting the wires directly together.

My thought process behind this essentially modular wiring system was that it would be easier to replace wires or disconnect anything.

For me it made installing and uninstalling the motors several times in a row much less annoying

Extra Photos

Just some pictures I didn't really have a set place for earlier